

Remarks

The Applicants note with appreciation the withdrawal of all of the previous rejections of the pending claims.

The Applicants acknowledge the rejection of Claims 1, 3 and 5 – 9 under 35 U.S.C. §103 over the newly cited Hassan publication. The Applicants respectfully submit that those claims are patentable over Hassan for the reasons set forth in detail below.

Hassan relates to the reduction of halogenated hydrocarbons in aqueous media and considers the potential involvement of sulfur in iron powder or metal filings used in connection with such reduction of halogenated hydrocarbons. Hassan specifically discloses two types of iron that may be used, namely laboratory-grade iron filings obtained from Fisher Scientific Company of Pittsburgh, Pennsylvania and extra pure iron powder obtained by AESAR of Ward Hill, Massachusetts.

The extra pure iron has a sulfur content of 20.1 ppb. In contrast, the iron filings have a sulfur content of 180.5 ppm. As such, the iron filings have a very low sulfur content, while the extra pure iron powder has an extremely low sulfur content. Such very low and extremely low sulfur contents are typical of the prior art previously employed in attempts to remediate media contaminated with halogenated hydrocarbons.

The extra pure iron and iron filings were mixed with ferrous sulfide produced from sodium sulfide and ferrous sulfate. This is the mechanism in Hassan in which sulfur is introduced into a composition utilized to reduce the halogenated hydrocarbons.

Such a process has nothing to do with the claimed process. This is because Hassan took a completely different approach to the introduction of sulfur into a reaction intended to reduce the halogenated hydrocarbons. Specifically, Hassan took very low sulfur-content iron and extremely low sulfur-content iron, separately added ferrous sulfide to produce a mixture, and then utilized the mixture in an attempt to reduce the halogenated hydrocarbons.

This is sharply different from the claimed process, wherein iron powder containing about 0.1 to about 2% by mass of sulfur was employed and the sulfur from the iron powder particles themselves was the source of the sulfur, not an external source of sulfur from separately added ferrous sulfide. This is demonstrated by a direct comparison between the content of the iron powder particles specifically claimed by the Applicants versus the content of sulfur in the iron filings and extra pure iron powder of Hassan. For example, the iron filings of Hassan had a sulfur content of 180.5 ppm. This is contrasted to the minimal sulfur content ppm claimed by the Applicants. In that

regard, the Applicants note that the claimed about 0.1% by mass of sulfur is the same as about 1,000 ppm of sulfur contained within the iron powder itself. The iron filings of Hassan have a sulfur content of 180.5 ppm, while the minimal amount of sulfur contained within the powder of the Applicants' invention is about 1,000 ppm.

In other words, the Applicants' claimed iron powder contains five times more sulfur within the particles of the iron powder than the iron filings of Hassan. Thus, the Applicants provide sulfur on at least portions of the surface of the iron powder by obtaining sulfur from within the powder. This is sharply contrasted to Hassan that separately adds ferrous sulfide to the very low sulfur content iron filings.

The drastic differences are still further illustrated as one progresses upwardly through the Applicants' claimed range of sulfur content up to about 2%. This results in a drastically higher sulfur ppm content as claimed by the Applicants which becomes about 100 times greater than the sulfur content of the Hassan iron filings.

The differences become even more dramatic when referring to the extra pure iron powder of Hassan which has a sulfur content of 20.1 ppb. Note that the drastic differences set forth above with respect to the iron filings were parts per Million. In the case of the extra pure iron powder of Hassan, the sulfur content is measured in parts per Billion. It can then be readily seen that the differences in the sulfur content as claimed by the Applicants versus the sulfur content of the iron powder of Hassan are different by orders of magnitude.

The result of the teachings of Hassan is that they employ very low sulfur content iron and add sulfur from an external source, namely ferrous sulfide. This is sharply contrasted to the claimed invention which obtains the sulfur for the surface of the particles from the particles themselves. The Applicants respectfully submit that one of ordinary skill in the art, viewing the teachings of Hassan, would in no way be led to modify the very low sulfur content powders of Hassan to increase the sulfur content of the iron powder particles themselves. One of ordinary skill in the art would readily glean from Hassan that the simple way to increase the amount of sulfur that may be employed to effect the reduction of the halogenated hydrocarbons should be achieved by adding sulfur from another source, namely ferrous sulfide. This is not what the Applicants claim and the Applicants respectfully submit that increasing the sulfur content of the iron powder particles themselves for the purpose of providing sulfur to the surface of the iron powder particles is nowhere taught nor

suggested in Hassan. The Applicants accordingly respectfully request that the rejection of Claims 1, 3 and 5 – 9, based on Hassan, be withdrawn.

The Applicants acknowledge the rejection of Claims 1, 3 and 5 – 9 under 35 U.S.C. §103 over the hypothetical combination of Hassan with Wolfe. The Applicants have already discussed the fatal deficiencies associated with the teachings of Hassan. The Applicants respectfully submit that Wolfe does nothing to cure those deficiencies. In fact, the teachings of Wolfe are, in many ways, incredibly similar to the teachings of Hassan. For example, the Applicants invite the Examiner's attention to Column 6 in the paragraph beginning at about line 22 wherein iron-containing compounds are disclosed. It is noteworthy that such iron materials are iron filings or iron powder obtained from none other than the same Fisher Scientific of Pittsburgh, Pennsylvania. This is the same material disclosed by Hassan. The Applicants have already established that the sulfur content claimed by the Applicants is dramatically higher than the sulfur content of the Fisher Scientific iron filings. As a consequence, Wolfe also goes to external sources to provide sulfur.

The Applicants note with appreciation the Examiner's helpful comments, especially those that the sulfur is "preferably present in the iron catalyst composition in an amount between 0.1 and 25%." Those teachings may be found in Column 6, beginning at about line 47 of Wolfe. However, those teaching refer to an iron composition, not the iron powder. The way that the "remediating iron composition" achieves the 0.1 to 25% sulfur content is by providing external sources of sulfur, such as those mentioned in Column 6, also beginning at line 52. Thus, the "iron composition" is not an apples-to-apples comparison between the Applicants' claims and the iron catalyst composition of Wolfe. The composition of Wolfe is the iron powder plus the sulfur source. In contrast, the Applicants specifically claim iron powder containing about 0.1 to 2% by mass of sulfur. These are sharply different components. The consequence of that difference is that the Applicants do not need to resort to an external source of sulfur to successfully achieve the reduction of halogenated hydrocarbons. That is because the iron powder of the invention contains a specifically claimed and enhanced amount of sulfur not taught or suggested by Wolfe (or by Hassan, as set forth above).

The Applicants, therefore, respectfully submit that, even if one of ordinary skill in the art were to make the hypothetical combination of Hassan with Wolfe, the resulting process would still be sharply different from that claimed herein. The Applicants have factually established, by the disclosures of Hassan and Wolfe themselves, that they employ very low sulfur content iron filings and that they both need to provide an external source of sulfur to provide the appropriate quantity of

sulfur to effect the dehalogenation reaction. This is not what the Applicants do, not what the Applicants are interested in and, more importantly, not what the Applicants claim. What the Applicants claim is the utilization of iron powder containing about 0.1 to about 2% by mass of sulfur. This internally-supplied sulfur provides for sulfur at at least portions of the surfaces of that iron powder as also specifically claimed.

Hypothetically combining Hassan with Wolfe would still lead one of ordinary skill in the art away from the invention as recited in the solicited claims. The Applicants therefore respectfully submit that both Hassan and Wolfe, taken individually or collectively, fail to teach or suggest the invention as recited in Claims 1, 3 and 5 – 9. Withdrawal of the rejection is respectfully requested.

The Applicants have added new Claims 13 and 14. New Claim 13 is fundamentally based on Claims 1 and 3 but also notes that after the forming step there is the subsequent contacting of the media with the iron powder such that the iron powder contacts the halogenated hydrocarbons contained in the media. Claim 14 recites that the forming of FeS is conducted by manufacturing the iron powder by water atomization of molten steel of the composition. Entry into the official file and consideration on the merits is respectfully requested.

The Applicants respectfully submit that Claim 13 is allowable over the art of record. For example, the Applicants respectfully submit that Hassan is inapplicable because the deposition of FeS on the iron powder of Hassan cannot occur before the step of contacting (mixing, for example) the media with the iron powder. Hassan also discloses that commercial iron contains S as a composition of the iron powder. However if any sulfide is precipitated on the surface of the powder, MnS forms in preference to FeS unless the amount of Mn is decreased to an amount less than the usual Mn content of commercial iron powder.

Also, Hassan and Wolfe both disclose including S-containing compounds irrespective of the type of compound. FeS is included in certain of their embodiments either because it is a matter of convenience such as mixing pyrite or it is an inevitable corollary such as depositing FeS created by the chemical reaction of NaSH and iron. In other words, they do not disclose, teach or suggest any advantages in the effects of having FeS over MnS. The Applicants respectfully submit that one of ordinary skill in the art would not bother to even attempt to precipitate FeS because MnS is much more convenient in the case of S containing iron powder. Also, there is a significant advantage in Claims 1, 2 and 6 compared to NaSH-originated FeS deposited on the iron powder.

With respect to Claim 14, neither of Hassan and Wolfe discloses, teaches or suggests

manufacturing iron powder by water atomization. Water atomization is anything but obvious inasmuch as other manufacturing methods such as electrical and reduction methods (adding desulfurizing agent) would not result in the precipitation of sulfides. Thus, the Applicants respectfully submit that Claims 13 and 14 are allowable over the art of record.

The Applicants enclose a Supplemental Information Disclosure Statement together with the usual Form PTO-1449 and copies of the publications. Entry into the official file with consideration on the merits is respectfully requested.

In light of the foregoing, the Applicants respectfully submit that the entire Application is now in condition for allowance, which is respectfully requested.

Respectfully submitted,



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